Can Patient Self-Management Explain the Health Gradient? Goldman and Smith (2002) Revisited[*]

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Abstract

In a much-cited paper, Goldman and Smith (2002) use samples of diabetic and HIV+ patients in the United States to conclude that disease self-management is an important explanation for the much-documented positive gradient in education and health outcomes. In this paper, I point to several fundamental difficulties in interpreting Goldman and Smith's results as conclusive evidence in favor of self-management. I also argue (using results from the same sample of diabetics) that for individuals for whom self-management might be expected to matter -- viz. populations of patients managing complex conditions -- economic factors such as resource availability and insurance access might be a more important mechanism behind the gradient than medical compliance. The impact of self-management, though it might matter, is likely to be small.

Keywords: education, health gradient, patient self-management, United States

Introduction

There is a large literature documenting the positive association between education and health outcomes, known as the education-health gradient. The association has been observed across countries and over time (Hurt, Rossmands & Saha, 2004; Khang, Lynch & Kaplan, 2004; Kitagawa & Hauser, 1973; Liang, McCarthy, Jain, Krause, Bennett & Gu, 2000; Manor, Eisenbach, Peritz & Friedlander, 1999; Mustard, Derksen, Berthelot, Wolfson & Roos, 1997), and has been found to hold for different measures of health outcomes, such as mortality, morbidity, physical functioning, health behaviors and self-reported health (Adler, Boyce, Chesney, Cohen, Folkman, Kahn et al., 1994; Berger & Leigh, 1988; Cutler & Lleras-Muney, 2007; Cutler & Lleras-Muney, 2008; Deaton & Paxson, 2001; Elo & Preston, 1996; Kenkel, 1991; Leigh & Dhir, 1997; Meara, 2001; Mirowsky & Ross, 2003; Pincus, Callahan & Burkhauser, 1987; Sander, 1995). There is also some evidence that the direction of causality can run both from education to health (Lleras-Muney, 2005) and from health to education (Case, Fertig & Paxson, 2005; Miguel & Kremer, 2004).

The continuing existence of the gradient indicates that education-driven health inequalities persist even as societies become healthier and more educated overall (Cutler & Lleras-Muney, 2008). If policy is to effectively alleviate such inequalities, we first need to understand the mechanisms that explain the gradient and the relative importance of different explanations. A large body of work has devoted itself to this task (Grossman, 2006; Mirowsky & Ross, 2003), but the mechanisms behind the gradient are still not perfectly understood.

A prominent group of theories focuses on the role of economic and labor-market-related factors in driving the education-health gradient (Cutler & Lleras-Muney, 2008; Mirowsky & Ross, 2003). Higher education facilitates full-time employment and the obtainment of better jobs (Pencavel, 1991; Ross & Wu, 1995). Better jobs have higher wages, leading to higher income, prevention of material deprivation and better access to quality health-care (Andrulis, 1998; Card, 2001; Fiscella, Franks, Gold & Clancy, 2000; Marmot, 2002; Pencavel, 1991). Better jobs also

typically entail better working conditions and more opportunities for productive self-expression (Brown, 1980; Kohn, 1976; Lazear & Oyer, 2007). All of these factors have a positive effect on health (Bindman, Grumbach, Osmond, Komaromy, Vranizan, Lurie et al., 1995; Karasek, Theorell, Schwartz, Schnall, Pieper & Michela, 1988; Ross & Mirowsky, 1995; Ross & Van Willigen, 1997; Zhang, Geiss, Yiling, Beckles, Gregg & Kahn, 2008). Moreover, the availability of resources has the additional psychosocial impact of alleviating the stress associated with economic hardship, providing yet another channel through which education can impact health outcomes (Fremont & Bird, 2000; Ross & Huber, 1985). Finally, economic stability can help to ease time and money constraints which impede the adoption of healthy practices (Cutler & Lleras-Muney, 2007).

While economic and job-related factors may matter, they do not account for the entirety of the education-health gradient (Cutler & Lleras-Muney, 2007; Cutler & Lleras-Muney, 2008; Lahelma, Martikainen, Laaksonen & Aittomaki, 2004; Mirowsky & Ross, 2003). Hence several other potential mechanisms have been explored in the literature.

One such set of non-economic theories invokes behavioral factors to explain the gradient. Social scientists have proposed that 'learned effectiveness' plays an important role in motivating behaviors that lead to healthier outcomes (Mirowsky & Ross, 2003). One aspect of learned effectiveness is cognitive: the ability to seek and use information to successfully achieve one's goals. Another aspect, such as 'personal control', is non-cognitive: the belief that personal actions are responsible for outcomes, and the confidence in one's ability to affect the same. Education is expected to enhance both cognitive and non-cognitive aspects of learned effectiveness by imparting specific knowledge and skills such as critical thinking (Cutler & Lleras-Muney, 2007; de Walque, 2004; de Walque, 2005; Lleras-Muney & Lichtenberg, 2002; Rosenzweig & Schultz, 1989; Spandorfer, Karras, Hughes & Caputo, 1995; Williams, Baker, Honig, Lee & Nowlan,1998), and by increasing exposure to and confidence in problem solving thereby generating a sense of control (Fremont & Bird, 2000; Mirowsky & Ross, 2003; Ross &

Wu, 1995; Seeman & Seeman, 1983; Seeman, Seeman & Budros, 1988). Education thus induces a greater effort and provides a more efficient path towards achieving the goal of good health.

Both the economic and behavioral mechanisms described above assume that good health is a universally desirable goal. But economists have argued that personal goals are themselves determined by individual preferences (Cutler & Lleras-Muney, 2007; Cutler & Lleras-Muney, 2008). Education could alter these preferences.

Specifically, it has been posited that education makes individuals more averse to risk; it also makes individuals value the future more or lower their discount rates (Becker & Mulligan, 1997; Fuchs, 1982; Leigh, 1990). All of these could lead to greater investment in health, and hence healthier outcomes. Early-childhood or inter-uterine environment has been suggested as another individual-specific factor that could be responsible for health outcomes (Barker, 1995; Barker, 1997; Case, Fertig & Paxson, 2005; Ravelli, van der Meulen, Michels, Osmond, Barker, Hales et al., 1998).

Yet another group of theories suggests that education affects health outcomes through its social impact. Education enables access to networks which provide financial, psychological and emotional support (Berkman, 1995; Berkman & Syme, 1979; Cutler & Lleras-Muney, 2008). Societal rank and peer effects have also been posited to influence health outcomes (Cutler & Glaeser, 2007; Marmot, 2002). Thus higher education may potentially have social consequences that are broadly health-positive.

Note that these and other mechanisms that have been suggested in the literature as potential drivers of the gradient are by no means mutually exclusive. For example, economic factors (such as employment, income and job characteristics) or social factors (such as social rank) can drive the gradient by enhancing personal control (Ross & Mirowsky, 1992) or a related concept, self-efficacy (Berkman, 1995; Mirowsky & Ross, 2003). A large literature has developed that attempts to explore the roles played by such linkages (Cutler & Lleras-Muney, 2007; Cutler & Lleras-Muney, 2008; Mirowsky & Ross, 2003). But these explanations often fail

to account for the entire gradient between education and health (Cutler & Lleras-Muney, 2007; Cutler & Lleras-Muney, 2008; Kenkel, 1991; Meara, 2001).

In a much-cited paper, Goldman and Smith (2002) argue in favor of disease-management as an important explanation for the education-health gradient. They posit that education may be associated with better health outcomes (specifically, with improvements in self-reported health status over time) due to the positive effect of schooling on self-management of a condition, after it has been detected. The argument is based on the cognitive advantage hypothesis of social scientists (Mirowsky & Ross, 2003). Education enhances cognitive skills and is hence a good proxy for the ability to comprehend and execute complex treatment regimens. Education is also a marker for the ability to internalize the future outcomes of poor self-management behavior. Hence schooling could have a positive effect on health, generating an education-health gradient.

To test this hypothesis, Goldman and Smith focus on patients from different samples suffering from two chronic conditions -- insulin-dependent diabetes and HIV -- known for the complexity of their treatment regimens. Treatment for diabetics often includes intricate combinations of oral medication and insulin injections, which need to be coupled with frequent monitoring of insulin levels. Likewise, treatment for HIV patients may involve complex permutations of medications where the timing and order in which pills are taken have to be carefully coordinated with each other and with meals. Hence, while treatments for both these conditions are potentially efficacious, the correct management of treatment regimens is vital to better health outcomes.

For each sample, Goldman and Smith show that poor self-management behavior (as they define it) is significantly more likely to lead to worse health outcomes over time. They then show that poor behavior is less likely to occur among the more educated. Using this two-step approach, they conclude that self-management has an important role to play in explaining the education-health gradient.

In this paper, I revisit the analysis of Goldman and Smith (2002) and point to several difficulties in interpreting their results as evidence that self-management drives the gradient. Furthermore, I argue using the sample of diabetics employed by Goldman and Smith that in those cases where self-management of conditions might truly be important -- viz., individuals with chronic conditions requiring complex treatment regimens -- the impact of economic factors such as resources and access to healthcare might well exceed that of self-management[1]. While cognitive ability is an advantage for successful disease self-management, it is not sufficient; a necessary condition for such management to be effective is the affordability of treatment. The availability of resources ensures that long-term complex treatments remain affordable; it also gives individuals the potential to bypass the need for self-management by facilitating the hiring of caregivers.

The next few paragraphs provide more detail on the analysis and conclusions reached in this study.

What are the main difficulties with interpreting Goldman and Smith's results as evidence of the role of self-management? I show that for each of the two samples of patients examined in their paper, controlling for poor self-management behavior does not reduce the improving impact of education on health. This violates a necessary criterion that must hold if any mechanism is to be interpreted as an explainer of the gradient, revealing a fundamental flaw in the two-step approach. In addition, I show that for the sample of diabetics, Goldman and Smith's result is driven by the definition of poor self-management behavior used. Using more precise definitions reveals a break in the two-step link and casts doubt on the robustness of the conclusion. Finally, I point out that the behaviors identified by Goldman and Smith as examples of poor medical compliance could in fact be doctor-prescribed responses to worsening health, instead of causes thereof. This raises concern that the associations obtained do not stem from the mechanism they attempt to establish.

Do the difficulties in interpreting Goldman and Smith's results imply that self-management does not play a role in explaining the gradient? I attempt to test this in the sample of diabetic patients by controlling for a more direct measure of cognitive ability -- Wechsler Adult Intelligence Test Scores (WAIS) -- to see if some part of the gradient is accounted for. I find that a portion (11%) of the gradient is indeed explained by this measure. Since cognitive ability is presumably a necessary, not a sufficient, condition for better self-management, I conclude that the latter could play a part in explaining the gradient, although the magnitude of the effect is likely to be less than the effect of cognitive ability as a whole.

If self-management has but a small role, what are the other possible explanations for the education-health gradient? I find that economic attributes such as resource availability and insurance access (but not perception of economic hardship) are the two most important individual factors: controlling for these factors individually reduces the gradient by 34% and 27%, respectively. Cognitive ability is the third most important factor, although the magnitude of its impact (11%) is only a third that of economic resources. Other factors that explain the gradient, albeit by very little, are health behaviors (such as smoking, drinking habits, exercise) and individual attitudes to risk. Considered jointly, all of these factors explain close to 60% of the gradient in education and health.

This leaves 40% of the gradient to be explained by mechanisms beyond those considered here[2]. It is possible that some of these mechanisms may be even more important than economic factors in driving the gradient; future research must apply itself to the task of identifying these mechanisms. However, the results obtained herein strongly suggest that economic factors matter more for explaining the education-health gradient than does disease self-management, in populations where the latter might be most important.

The rest of the paper is organized as follows. The next section presents a replication of Goldman and Smith's analysis using two samples of diabetics and HIV+ patients, along with a discussion of why the conclusions they reach may be invalid. The third section attempts to answer

the question of whether cognitive ability can be rejected as a potential mechanism behind the gradient. The fourth section outlines some of the major theories forwarded in the literature as explanations for the gradient, and tests the relative importance of cognitive ability vis-à-vis several of these mechanisms. The final section summarizes results and concludes the paper.

Does patient self-management explain the gradient? Revisiting Goldman and Smith

Goldman and Smith (2002) use three U. S. datasets and two conditions (diabetes and HIV) to assert that adherence behavior is an important component of the education-health gradient. I use two of these samples -- one of diabetic patients from the Health and Retirement Study (HRS) and the other of HIV+ patients from the HIV Cost and Services Utilization Study (HCSUS) -- to point to some difficulties in interpreting their results.

For each of these samples (which are panel data) Goldman and Smith employ a two-step argument to demonstrate that self-maintenance explains the gradient, defined using change in self-reported health over time. First, they show that poor adherence to treatment regimens by patients increases the likelihood of their reporting a deterioration in health between the first and later waves. Next, they demonstrate that such poor behavior is significantly less likely to occur among more educated respondents. Put together, the results of the two steps are taken to imply that education is likely to reduce the type of self-management behavior that is associated with a worsening of health over time. Hence, self-management is argued to be one of the mechanisms that drive the education-health gradient.

Replication of Goldman and Smith (2002): Diabetic patients (HRS)

In this subsection, I describe the HRS data and replicate Goldman and Smith's (2002) results for diabetic patients using their definition of poor self-maintenance behavior.

The sample is drawn from the first four waves of the Health and Retirement Study (HRS), a nationally representative longitudinal survey of 12,650 respondents born between 1931

and 1941, and their spouses. The respondents are followed over time at two-year intervals, beginning in 1992. Here I use the first four waves of the survey, viz. those conducted in 1992, 1994, 1996 and 1998. The sample I use includes 862 respondents who reported being diagnosed with diabetes in the first wave and who are followed in each wave till 1998.

Goldman and Smith define poor adherence behavior as any one or more of three practices observed in patients -- if a patient on any treatment regimen stops completely (practice A), if she switches from one treatment regimen to another before returning to the original regimen (practice B) or if she adds a second treatment over time to the first (practice C).

Table 1 reveals that 23.5% of all respondents display Goldman and Smith's definition of poor behavior A/B/C (an indicator for patients who follow practice A or B or C). From this 23.5%, a clear majority (16.7%) exhibit practice C, compared to 6.8% for practice A and 7.2% for practice B. Furthermore, the proportion of respondents who engage in practice C *alone* (11.6%) is significantly greater than those who engage in practice A alone (4.3%) or practice B alone (0.5%). These findings suggest that practice C may be more important than the others in driving Goldman and Smith's results, both because it individually accounts for the largest proportion of observations and also because removing it from the definition of poor behavior drastically reduces the number of observations.

A closer look at practice C, however, raises the concern that it may be the effect of poor health rather than the cause. Recall that C is defined as the practice of adding a second treatment to the one the patient was already undergoing. But this practice may plausibly represent adherence to a new treatment regimen prescribed by the doctor in response to health conditions. Certain medications for diabetes may become ineffective upon prolonged use (Roach, 2000). In such an event, the health of the patient -- as determined by the duration and severity of her condition -- would guide the treatment prescribed to her, which in turn would drive her observed self-management behavior. Also, diabetes is known to be associated with, and increase the risk of, co-morbidities such as high blood pressure, stroke and heart conditions (Fillenbaum, Pieper,

Cohen, Cornoni-Huntley & Guralnik, 2000). The prescribed treatment could, therefore, be a reflection of the complexity of the patient's health condition (Winocaur, 2002) as determined by the presence of co-morbidities and their implications regarding the severity and duration of diabetes. Hence, what appears to be poor self-management practice could in fact represent adherence to more complex treatment regimens that are prescribed to patients with worsening health. Indeed, this direction of causation -- from poor health to poor behavior -- is potentially plausible for each of the three practices included in Goldman and Smith's definition of poor self-management behavior.

Table 2 reports respondents' health in the baseline wave and their self-maintenance behavior (A/B/C) over time. There is a clear pattern of poor self-maintenance being more likely to occur among respondents with worse health in the baseline wave, with the difference being statistically significant. This is consistent with the view that causation could run from poor health to poor behavior. 25% of individuals who had been diagnosed with hypertension, a lung condition (other than asthma), cancer, stroke, a heart condition, a psychiatric condition or arthritis in the baseline wave engage in poor self-management behavior over time, compared with only 16% of those without any of these conditions. Similarly, 27% of respondents who report symptoms such as back, foot, bladder or stomach problems or high cholesterol or asthma in 1992 also engage in poor self-maintenance behavior in the next four waves, while only 13% of individuals without these problems do so. This pattern is repeated for Activities of Daily Living (ADL), body mass index and the depression index.

These findings cast doubt on Goldman and Smith's conclusion. If poor self-management behavior is indeed a response to rather than a cause of poor health, then their interpretation of the two-step result -- viz. that education improves health by facilitating better self-management -- would no longer be valid.

Tables 3 to 6 replicate the results obtained by Goldman and Smith. The following discussion outlines the broad patterns observed in these tables, which are consistent with the findings of Goldman and Smith.

Table 3 presents the baseline self-reported health status of all respondents in 1992 as well as those who reported diabetes. The education-health gradient is immediately evident from this table. About 30% of respondents who have not completed high school report excellent or very good health, while almost three-quarters of college educated respondents report the same. Similarly, 38% of respondents who have not completed high school education report fair or poor health, whereas only 6% of college-educated respondents do the same. For diabetics, bad health is more common but the gradient persists. 69% percent of the least educated category report fair or poor health whereas only 25% of the most educated do the same.

Table 4 reports on the patterns of treatment among diabetic patients at the baseline survey. Like Goldman and Smith, I find a negative gradient between education and switching behavior (practice B). For example, 47% of the least educated category report switching in oral medication while 29% of the most educated category do so. For insulin use, 24% of the least educated category are known to switch treatments, whereas only 13% of the most-educated category do so.

Table 5 reports results from ordered probits of change in self-reported health between the first and fourth waves, on education and other controls. As expected, higher education is associated with an improvement in health over the waves (see column (1)). In particular, respondents in two categories of education -- 12 years and 13-15 years -- are significantly more likely to report an improvement in health, compared with respondents who have not completed high school (0-11 years). The negative coefficients on education categories represent the education-health gradient. (Note that the dependent variable is +1 for a deterioration of health, 0 for no change and -1 for an improvement in health over the waves.)

Column (2) of Table 5 introduces poor self-maintenance behavior as an independent variable. I use the same definition of poor behavior (A/B/C) as Goldman and Smith, and like them, I find that poor behavior defined as such increases the likelihood of a worsening of health across the waves. This is the first step in the two-step argument of Goldman and Smith. However, including poor self-maintenance behavior does not appear to have much impact on the education-health gradient. The size of the coefficients on two categories of education (12 years and 16+ years) is slightly reduced (by 2% and 6.5% respectively) and that on the third category (13-15 years) increases very slightly (by 1%), after including poor self-management behavior. This finding casts serious doubt on the hypothesis that poor self-management behavior *explains* the gradient.

Table 6 reports results from probits of poor self-management behavior (A/B/C) on education and other controls. I find that college-educated respondents (16+ years) have a significantly lower probability of engaging in poor adherence behavior (as defined above) compared with those who have not completed high school (0-11 years). As before, this result is also consistent with the findings of Goldman and Smith and constitutes the second step in their two-step argument. However, note that Table 5 shows no significant difference between the health outcomes of those with 16+ years of education and those with 0-11 years. This again raises doubt that self-management explains the education-health gradient[3].

The results of Tables 5 and 6 taken together, indicate that poor self-management behavior is associated with a worsening of health, and that higher education lowers the likelihood of such behavior. Goldman and Smith interpret this two-step result as evidence that self-management of health explains the education-health gradient. However, for this interpretation to be valid, not only must higher education be negatively associated with poor self-management behavior, but the impact of such behavior on health must operate through higher education. The latter condition is not necessarily proven: the two-step argument used by Goldman and Smith focuses on the effect of poor self-management on health which is *independent* of education (Table 6). Thus the overall

conclusion need not be valid, as evidenced by the fact that controlling for adherence hardly reduces the size of the gradient.

I show in the next subsection that even the result obtained using the two-step logic depends critically on the way in which poor self-management behavior is defined. This further weakens the argument that self-management is an important explainer of the gradient.

Other definitions of 'poor' self-management behavior: Diabetic patients (HRS)

In this subsection, I shall repeat the regressions in Tables 5 and 6 by redefining poor behavior to include practices A, B and C individually and in all possible combinations. The results are presented in Tables 7 and 8.

The motivation for this exercise is as follows. Goldman and Smith have defined the key variable -- poor self-management behavior -- as an indicator that the patient engages in practice A or B or C. The definition is clearly based on the premise that each of these practices individually represents poor examples of medical compliance. Therefore, if poor self-management were indeed responsible for a part of the gradient, we would expect to find a reduction in the (improving) effect of education on health when any of these practices (individually or in some combination) are controlled for. This is the fundamental test of whether a mechanism explains the gradient, as argued in the previous subsection. Further, if we chose to employ Goldman and Smith's two-step logic, we would expect to find that the type of poor practice that is associated with a worsening of health over time must also be the type of practice that is observed less in more educated patients. Since poor behavior as defined by Goldman and Smith is a combination of three practices A, B and C, it is not clear if the above criterion is met.

To see this point, consider two hypothetical practices X and Y that may each be considered to represent poor self-management. If X is associated with worsening health but not with education, and Y with education but not with health, then taken individually neither behavior X nor Y would satisfy the two-step criterion of Goldman and Smith (i.e. be significantly

correlated both with change in health and with education). Hence, if poor behavior were defined by X alone or Y alone, there would be no evidence that self-management plays a role in explaining the education-health gradient. However, if bad behavior were defined as a combination of X or Y (i.e. as any one or more of X or Y), then the definition could meet the two-step criterion, and such behavior would be (mis)interpreted as explaining the education-health gradient. In the following paragraphs, I argue that this is indeed the case.

The first point to note from Table 7 is that controlling for poor behavior does not reduce the education-health gradient by much (compare with column 1 of Table 5), even when poor behavior is broken down into different components[4]. Hence, this finding -- which mirrors a similar result from the previous subsection -- is robust to the manner in which poor self-management behavior is defined. As argued before, this result casts serious doubt on whether self-management -- as defined by practices A, B, C or any combination thereof -- does indeed play a noteworthy role in explaining the education-health gradient.

Table 7 (Panel A) further reveals that behaviors B and C are both likely to be associated with a worsening of health over time, and the effects are significant (this is very similar to the result obtained in Table 5 (Column 2)). However, behavior A does not have a significant impact on health over time. Meanwhile, Table 8 (Panel A) shows that behavior A is significantly (negatively) associated with education, but not behaviors B or C. Thus the behaviors (B and C) that adversely impact health are not made less likely by education; conversely the behavior that education is likely to curtail (A) has no significant impact on health! The two-way link is thus broken, when self-management practices are considered individually.

The break in the two-way link is also evident in results involving combinations of practices. Table 7 (Panel B) suggests that behavior C is a necessary and sufficient component of any combination of practices that has a significant effect on health. This follows from the fact that behaviors A/C, B/C and A/B/C are significantly associated with a worsening of health over time while behavior A/B is not. Moreover, from Table 8 (Panel B), it is clear that each of these

behaviors is also significantly (negatively) associated with education (the coefficient on at least one category of education is significant for each). Hence, the two-step criterion is satisfied and the gradient appears to be explained for these combinations of practices -- A/C, B/C and A/B/C. However, C alone is not significantly associated with education (Table 8, Panel A), suggesting that a combination of practices including C must be used for a significant relationship between education and such behavior to emerge. This again suggests that the two-step result obtained by Goldman and Smith is an outcome of their aggregated definition of poor behavior.

It is possible that these results are being driven by an insufficient number of observations. But recall that practice C, which is a necessary component of all behaviors that satisfy the two-step criterion, could plausibly be a response to worsening health and not a cause thereof. Thus even if we focus only on those behaviors that explain the gradient, the final conclusion -- that education improves health by enhancing self-management -- is open to question.

Replication of Goldman and Smith (2002): HIV patients (HCSUS)

As a robustness check, Goldman and Smith (2002) test the importance of disease self-management using another condition known for the complexity of its treatment regimens, viz. HIV. Here I briefly show, using the same data, that these results also suffer from some of the fundamental difficulties of interpretation discussed above.

The data used for the analysis in this section is from the HIV Cost and Services Utilization Study (HCSUS), described in detail in Frankel, Shapiro, Duan, Morton, Berry, Brown et al. (1999). The HCSUS used a multistage national probability sample design to obtain a representative sample of adult HIV+ patients in care. For each sampled patient, the study conducted three rounds of interviews between January 1996 and January 1998. Goldman and Smith used data from the baseline survey and the final round, and identified patients receiving highly active antiretroviral therapy (HAART) by using the definition provided by Andersen, Bozette, Shapiro, St. Clair, Morton, Crystal et al. (2000). A patient (in the third wave) is

considered adherent if she reported taking each medication she was prescribed, for each of the past 7 days. As in the HRS study, health is measured by the difference in self-reported health status between the first and third waves. The health variable takes the value +1 if health deteriorated, 0 if it stayed the same and -1 if it improved between the baseline and third waves.

The argument used by Goldman and Smith to establish the importance of adherence is based on the same two-step logic used for diabetics. They show (controlling for a host of factors) that while using HAART has a worsening effect on health over time, using HAART and adhering to the regimen is associated with improved health over time. Moreover, the probability of using HAART and adhering increases with education level. Hence, they conclude that adherence is an important mechanism behind the education-health gradient.

As before, the fundamental test of the hypothesis that adherence explains the gradient is to show that controlling for adherence reduces the magnitude of the gradient. Table 9 (column (1)) presents the ordered probit run by Goldman and Smith and compares the education coefficients with those in the regression that do not include the adherence variables (column (2)). Two interesting facts emerge. First, there is hardly a gradient in education and health in the regression of column (2). The coefficients on individuals with high school (12 years) and college (13-15 years) education are positive (indicating worse health than those with 0-11 years of education) and all coefficients are insignificant. Second, controlling for HAART treatment and adherence to HAART treatment has very little impact on the magnitude of the education coefficients. This puts the conclusion that Goldman and Smith derive from their two-step argument once more into question[5].

Is self-management to be rejected as a potential mechanism behind the gradient? Results using HRS

The results presented above cast doubt on the claim that self-management plays an important role in explaining the education-health gradient. However, it is important to remember that these

findings only point to drawbacks in interpreting a particular set of results obtained by Goldman and Smith (2002) as evidence in favor of self-management. Can we then reject self-management or cognitive advantage as a potential mechanism behind the gradient?

To answer this question, I turn to the impact on the gradient of a more direct measure of cognitive advantage than that used by Goldman and Smith. The reasoning behind this approach is to test if a necessary condition for better self-management -- viz. higher cognitive ability -- is successful in explaining the gradient and if so, by how much.

I focus on the HRS sample used by Goldman and Smith since the gradient obtained in the HCSUS sample is already small. As a measure of cognitive ability, I use the Wechsler Adult Intelligence Scores (WAIS) of patients provided in the first wave of HRS.

The results are presented in Table 10, Panel A. The baseline regression (the same as reported in Table 5, column (1)) demonstrates the gradient in education and health. Respondents with 12 years or 13-15 years of education are significantly more likely to report improved health between the first and fourth waves of HRS, compared with respondents who have 0-11 years of education. Including WAIS scores in the regression reduces the significant education coefficients in the baseline regression by about 9-11% (column (2)-(3)). Hence, cognitive ability does explain a part of the gradient, even though it leaves a statistically significant portion unexplained[6]. Moreover, higher education is found to be significantly associated with higher cognitive ability, as demonstrated by the regression in Panel B[7]. Since cognitive advantage is most likely a necessary, not sufficient, condition for better disease self-management, I conclude that while self-management could play a role in explaining the gradient, its effect is likely to be smaller than 9-11%.

Using different test scores of cognition and comparing results from different US samples, Cutler and Lleras-Muney (2007) infer that cognitive ability is an important mechanism driving the gradient in health behaviors. They argue, in particular, that reasoning and scientific beliefs matter more for explaining the gradient (in health behaviors) than health knowledge. It is not

possible to test this hypothesis in the present sample due to the unavailability of data on respondents' health knowledge. However, the overall impact of cognitive ability estimated here is lower than that summarized by Cutler and Lleras-Muney (2007), albeit for the gradient in health behaviors.

How important is cognitive ability vis-à-vis other potential explanations for the gradient? I investigate this question in the next section.

Alternative mechanisms

In this section, I explore some alternative mechanisms that might be important for explaining the gradient. Broadly in keeping with the substantial literature on the subject, I divide the mechanisms into four categories: economic well-being, health behaviors, preferences and social connectedness. The results, using the HRS sample of diabetics described above, are presented in Panels A of Tables 11 – 14 and discussed below. Panels B of these tables demonstrate the impact of higher education on the mechanism under discussion. Details of regression controls and variable definitions are provided in Data Appendix I and II.

Economic well-being

A potential channel through which higher education could lead to better health is economic well-being. Higher education facilitates the obtainment of better jobs leading to higher wages (and hence higher income and better access to health care), better working conditions and more opportunity for productive self-expression, each of which has a positive effect on health (Cutler & Lleras-Muney, 2007; Cutler & Lleras-Muney, 2008; Mirowsky & Ross, 2003). Furthermore, higher resources alleviate economic hardship and the associated stress, providing an additional channel by which health improvements can occur. I attempt to capture economic well-being using three measures: resource availability, access to health insurance and perception of economic hardship[8].

As a measure of resource availability, I define dummies for households lying in the bottom, middle and top third of the distribution of household net worth. Data on net worth are provided in the first wave of the HRS. For access to health insurance, I use indicators for whether the respondent accesses federal insurance (Medicare, Medicaid, Champus, VA or other military programs), employer-provided insurance (either of self or spouse) or directly purchased insurance (from an insurance company or an organization such as the AARP). Finally, I look at respondents' perception of economic hardship through their responses to three questions: (i) Are you very satisfied, somewhat satisfied, about evenly satisfied or dissatisfied, somewhat dissatisfied, or very dissatisfied with your financial situation? (ii) Compared to two years ago, are you [and your husband/wife/partner)] financially much better off, somewhat better off, about the same, somewhat worse off, or much worse off? (iii) Looking ahead to two years from now, do you think you [and your husband/wife/partner)] will be financially much better off, somewhat better off, about the same, somewhat worse off, or much worse off? (Precise variable definitions are given in Data Appendix II.)

Table 11 presents the results. Resource availability, as represented by household net worth, has a noticeable impact on the gradient. Including resource availability reduces the significant education coefficients in the baseline regression by 32-34% and renders each of them statistically insignificant. Furthermore, the more educated are significantly more likely to be in the upper third of the net worth distribution than in the lowest third (Panel B).

Access to insurance also has a prominent effect on the gradient as it reduces the significant baseline education coefficients by 22-27%, rendering all but one of these coefficients statistically insignificant. Being more educated is also positively associated with having access to all (i.e. employer-provided and directly purchased) but federal insurance. This is not surprising as Medicaid and Medicare are typically accessed by individuals of low socioeconomic status.

Together, resource availability and insurance access account for 44-51% of the gradient, leaving all education coefficients statistically insignificant. The perception of economic hardship,

however, does not impact the gradient, even though being college-educated significantly reduces the likelihood of dissatisfaction with one's current financial condition or of expectations that financial conditions will worsen in future.

The results of Table 11 suggest that economic well-being is an important mechanism behind the education-health gradient. It is worthwhile also to consider the manner in which this mechanism might work. The failure of perception of economic hardship to explain the gradient suggests that the relevant channel of operation is less likely to be psychological factors -- such as stress, insecurity and helplessness stemming from economic hardship -- than the more direct consequences of economic well-being, such as the affordability of healthy lifestyles and access to healthcare.

The role of economic resources and insurance access found here is larger than that reported in several existing studies (Mirowsky & Ross, 2003), which have found that the stress of economic hardship is more important for driving the gradient than material resources, including availability of insurance. However, it is important to note that the present sample is restricted to patients who are actively managing a condition requiring complex treatment regimens such as multiple medications and injections. For this subset of individuals, it seems very plausible that economic resources and access to healthcare would be more helpful for successful disease management, and hence better health, than in the general population. Better resource availability would not only facilitate more regular and timely purchase of medications but also the purchase of services -- such as home care -- that could ensure better disease management. Access to better healthcare (such as comprehensive medical insurance and prescription drug coverage) could likewise have a larger role to play in explaining the gradient for such patients than in the general population.

Some studies that report a similar impact of economic factors on health gradients in the United States are Cutler and Lleras-Muney (2008) (who analyze the gradient in self-reported 'fair' or 'poor' health using data from the National Health Interview Survey), Cutler and Lleras-

Muney (2007) (who look at the gradient in health behaviors for respondents in the third wave of HRS) and Ross and Wu (1995) (who define the gradient as in this paper and report results using the National Survey of Personal Health and Consequences). However, not all these analyses use the same health outcomes or control for the same components of economic well-being, making it hard to compare results across studies.

Health behaviors

The positive impact of education on health has been attributed to healthier behaviors exhibited by more educated individuals. Social scientists have argued that schooling generates healthier behaviors by inculcating 'learned effectiveness' in individuals. Learned effectiveness has a cognitive dimension -- the ability to seek and use information successfully -- and a non-cognitive dimension, such as personal control -- the belief that personal actions are responsible for outcomes and the confidence in one's ability to affect the same. Schooling enhances both these dimensions, enabling individuals to combine available inputs more effectively to produce good health (Grossman, 1972). The unavailability of data in the HRS (wave 1) on health knowledge or personal control indicators (measuring respondents' beliefs in the efficacy of personal actions) prevents the testing of this theory directly. However, I am able to estimate the impact of health behaviors on the gradient.

I focus on three habits that combinedly determine health behavior: current smoking, exercise habits and drinking habits. The results, presented in Table 12 (Panel A), show that health behaviors explain a very small part of the gradient -- only 0-6% of the significant baseline education coefficients.

While the impact on the gradient is negligible, the associations between health behavior and education (Panel B) are broadly consistent with the literature (Cutler & Lleras-Muney, 2007; Mirowsky & Ross, 2003). Higher education is negatively associated with not drinking at all, it has a significant positive effect on rare or moderate drinking, and it does not significantly alter

heavy drinking. Higher education also has a significant positive effect on exercise. The small and insignificant relationship between education and smoking is surprising but could be driven by selection, i.e. the fact that the most intense smokers would have died at the older ages sampled in HRS.

Preferences

The theory of learned effectiveness assumes that good health is a desirable goal for all individuals. Economists have argued, however, that personal goals are determined by individual characteristics such as tastes and preferences (Cutler & Lleras-Muney, 2007; Cutler & Lleras-Muney, 2008). Education could impact health by altering these characteristics. Some mechanisms that have been suggested are risk aversion and discount rates or measures of how much individuals value the future. Education might make individuals more averse to risk, which in turn leads to better health investments and hence better health. Alternatively, education could lower discount rates or make individuals value the future more (Becker & Mulligan, 1997) (possibly because it enhances future income), leading to better health investments and outcomes[9]. Note, however, that preference parameters such as risk aversion and value of future are difficult to measure and the existing evidence on their importance in explaining the gradient is small and weak (Fuchs, 1982; Leigh, 1990).

Following Cutler and Lleras-Muney (2007) and Barsky, Juster and Kimball (1997), I measure respondents' risk aversion using their answers to two questions about income: (i) Suppose that you are the only income earner in the family, and you have a good job guaranteed to give you your current (family) income every year for life. You are given the opportunity to take a new and equally good job, with a 50-50 chance it will double your (family) income and a 50-50 chance that it will cut your (family) income by a third. Would you take the new job?

If the answer to (i) is 'yes', the respondent is asked: (iia) Suppose the chances were 50-50 that it would double your (family) income, and 50-50 that it would cut it in half. Would you still

take the new job? If the answer to (i) is 'no', she is asked: (iib) Suppose the chances were 50-50 that it would double your (family) income and 50-50 that it would cut it by 20 percent. Would you then take the new job? Based on the joint answers to (i) and (ii) four categories of risk preference may be defined. Those who answer 'yes' to both questions are the least risk averse whereas those who answer 'no' to both are the most risk averse.

How much respondents value the future is measured by their answers to the question: In deciding how much of their (family) income to spend or save, people are likely to think about different financial planning periods. In planning your (family's) saving and spending, which of the time periods listed in the booklet is most important to you (next few months, next year, next few years, next 5-10 years, longer than 10 years)? The longer the planning horizon, the higher is the value of future in the respondent household.

The results, presented in Table 13, reveal that preference indicators have a very small effect on the gradient, and sometimes alter the education coefficients in the wrong direction[10]. While the more educated do value the future more (Fuchs, 1982), this parameter does not appear to explain the gradient at all. Risk preference explains only 2-3% of the significant education dummies in the baseline. Also, consistent with evidence in the existing literature (Barsky, Juster & Kimball, 1997), the relationship between education and risk preference is found to be non-monotonic (albeit insignificant), i.e. risk aversion is highest for middle levels of education (column (1), Table 13, Panel B).

Social connectedness

Belonging to close-knit social networks could provide financial, physical and emotional support and also affect health behaviors through peer effects. Hence, membership in social networks could constitute yet another mechanism behind the gradient if educated individuals are more likely to have greater social connections (Berkman, 1995; Cutler & Lleras-Muney, 2008; Mirowsky & Ross, 2003).

The indicators used here to measure social support are constructed based on respondents' answers to the following seven questions: (i) Do you have any relatives in this neighborhood? (ii) Do you have any good friends living in this neighborhood? (iii) Among your nearby neighbors, that is, the ten to fifteen families living closest to you, how many of the adults would you know by name if you met them on the street: all of them, most of them, some of them, or none of them? (iv) How often do you get together with any of these neighbors just to chat or for a social visit: daily or almost every day, several times a week, several times a month, several times a year, or hardly ever? (v) How satisfied or dissatisfied you are with your friendships? (vi) How satisfied or dissatisfied you are with your family life? (vii) Suppose you [and your (husband/wife/partner)] ran into severe financial problems in the future. Do you have relatives or friends who would be both willing and able to help you out over a long period of time?

The existing evidence on social networks suggests that its role in explaining the gradient is limited (Berkman & Syme, 1979; Mirowsky & Ross, 2003). This view is supported in the results presented in Table 14, Panel A, where social indicators fail to account for much of the gradient and sometimes lead to an alteration of the education coefficients in the wrong direction. Also, the results in Table 14, Panel B fail to support the notion that more educated individuals are more likely to be socially connected as defined by these indicators.

How much have we explained?

Table 15 presents a regression that controls for all factors that were found to explain the gradient, i.e. change the baseline education coefficients in the right direction. The results show that these factors -- resource availability, insurance access, cognitive ability, risk aversion and health behaviors -- combinedly explain 55-57% of the significant baseline education coefficients (which are all rendered insignificant after controlling for the mechanisms). This estimate is comparable with those found in the literature (55-80%), albeit for different definitions of gradients and controls (Cutler & Lleras-Muney, 2007; Ross & Wu, 1995). However, the analysis still leaves a

large part of the gradient unexplained. Some of the unexplained effect may be due to the inability to test for certain mechanisms already cited in the literature -- such as personal control or health knowledge -- which may be expected to be associated with education and thereby explain its positive gradient with health. However, studies that have attempted to control for these mechanisms do not successfully account for the entire gradient either (Cutler & Lleras-Muney, 2007). Future research must therefore apply itself to the task of identifying further mechanisms that might successfully explain the basis of persistent health inequalities due to education.

Despite its inability to explain the gradient in entirety, the current analysis does provide some important pointers on the relative importance of different mechanisms for driving the gradient. Of the explanations considered here, resource availability and insurance access are found to explain, respectively, 34% and 27% of the gradient when considered individually and 44-51% when taken together. Moreover, controlling for resource availability (insurance access) alone renders all three (all but one of the three) education coefficients statistically insignificant. These may therefore be considered to be the two most important individual factors -- of the ones considered here -- that drive the gradient. This result (coupled with the low impact of perception of economic hardship) is strongly suggestive of the importance of economic well-being -- particularly material resources and access to health care -- as a driver of the gradient, for populations of patients who are required to actively manage a complex condition. The effect of cognitive ability (11%) is only a third that of resource availability, and two of the three education coefficients continue to be significant even after it has been controlled for. Moreover, since cognitive advantage is presumably a necessary, not sufficient, condition for better disease self-management, the impact of the latter on the gradient is likely to be even less in magnitude. Nevertheless, cognitive ability constitutes the third largest individual factor that explains the gradient, suggesting that the role of disease self-management may matter too.

Finally, while identifying the mechanisms that drive the association between education and health is necessary, it is important also to understand to what extent the effects may be

interpreted as causal. Estimating the sizes of causal effects has important implications for policy, since these will indicate whether exploiting the causal mechanism might be more effective in reducing health inequalities than targeting education improvements (Cutler & Lleras-Muney, 2008). Recall that the current analysis studies the impact of various mechanisms on the health gradient, defined by change in self-reported health over time. Absent measurement errors, this would suggest that reverse causality issues are minimized since most of the explanatory variables and controls are values corresponding to the base period. However, there could be third factors that are responsible, at least in part, for the effects obtained herein. For example, the impact of cognitive ability could be driven not (only) by the learned effectiveness imparted by schooling but instead (also) by the fact of higher-ability individuals choosing higher levels of education. The estimates obtained here, while providing strong suggestive evidence regarding which mechanisms might be most important in explaining the gradient for chronically ill patients, are best interpreted as sensitivity estimates till further studies carefully establish the causal components of the same.

Summary and conclusion

There is a much-documented and persistent gradient in education and health, but the mechanisms behind it are not well understood. The existing literature points to economic well-being (such as higher income, better jobs and better access to healthcare), psycho-social factors (such as personal control, cognitive ability and social connectedness) and health behaviors as potential explanatory mechanisms, but controlling for these still leaves a large part of the gradient unaccounted for.

In an influential paper, Goldman and Smith offer the argument that education might enhance health by enabling better self-management of chronic conditions. They test this theory for patients with two conditions -- diabetes and HIV -- that are known to have notoriously demanding treatment requirements.

In this paper, I show using Goldman and Smith's data on diabetic and HIV patients that there are some fundamental difficulties in interpreting their results as evidence in favor of self-management. Using their data on diabetic patients, I then investigate some alternative mechanisms that might drive the gradient. I show that economic factors (resources and insurance access) constitute the most important individual mechanisms that explain the gradient (34% and 27% respectively) followed by cognitive ability (11%). Since cognitive ability is presumably a necessary, not sufficient, condition for better self-management, this implies that the impact of self-management is even smaller.

The large impact of economic resources on the gradient could be driven, at least in part, by the (reverse) causal effect of poor health on resource depletion. Since the gradient is defined using change in health across time with most explanatory variables and controls corresponding to the base period, the potential for reverse causality is arguably reduced (Ross & Wu, 1995). However, the design is by no means a perfect tool for resolving issues of reverse causality, and the results must be interpreted bearing this in mind.

To the extent that reverse causal effects are minimized, therefore, the above results suggest that for individuals living with a chronic condition that requires extensive management (as here), treatment affordability might take precedence over self-management as a means of improving health. At a more fundamental level, the findings point against Goldman and Smith's suggestion that self-management might be more important than other mechanisms in explaining the gradient.

Other factors that are found to play a role, albeit small, in explaining the gradient are health behaviors and attitudes to risk. Social connectedness, valuation of the future and perceptions of economic hardship do not play a role in explaining the gradient at all. Taken together, resources, insurance access, cognitive ability, health behaviors and risk attitudes explain close to 60% of the gradient, a magnitude comparable to that found in other studies. The remaining unexplained portion could be explained by factors not included in the analysis, or by

improper measurement of mechanisms that have been considered. This highlights the need for future research to explore other potential channels via which education leads to better health, and to design reliable and robust ways to measure the causal effects of the same.

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Endnotes

[1] I show that the magnitude of the gradient in the sample of HIV+ patients is negligible and hence not amenable to the analysis required to make this argument. However, the basic patterns reflected in the HIV sample also point to the same conclusion.

[2] For example, the role of personal control or the impact of inter-uterine environmental factors is not explored in this paper. Variables that appropriately measure these mechanisms are unavailable in the survey.

[3] I am grateful to an anonymous referee for highlighting this point.

[4] The coefficients on education in Table 7 are between 6.5% smaller and 2% larger in size than the corresponding coefficients in column (1) of Table 5. The median change in the size of coefficient, upon controlling for poor behavior, is a reduction of 1.6%.

[5] Note that Goldman and Smith control for factors in column (1) -- such as insurance and income -- which could be competing explanations for the gradient. When the ordered probit is run without these variables, a small gradient does emerge. However, income and insurance are found to individually explain far more of the gradient (36% and 51% respectively) than adherence (6%). These regressions are available from the author upon request.

[6] Using an alternative measure of cognitive advantage -- individual perceptions of own cognitive ability -- generates a similar (albeit slightly lower) reduction in the gradient. Results are available from the author upon request.

[7] Note that this finding could be driven by a causal effect of education on cognitive ability but also by the possibility that individuals with higher innate cognitive ability are the ones that acquire more education.

[8] Since only 47% of sample respondents are currently working I do not test the aspects of economic well-being represented by 'quality' of occupation, such as working conditions and the degree of productive self-expression it might permit.

[9] Note that tastes and preferences could constitute a third factor that determines both education and health outcomes. For example, individuals who value the future more could be more likely to acquire higher education, as well as invest in better health

[10] As in the existing literature on the subject, the indicators used here to measure preferences focus on monetary outcomes and not on health outcomes. Risk preferences and discount rates over health outcomes are especially hard to measure and unavailable in the current survey.

Data Appendix I: Controls Used For Different Mechanisms Used in Panel A, Tables 10 - 14

Table	Column	Mechanism	Controls other than those in Baseline (col. 1)[a] All variables are from Wave 1 (1992)
10	2	Cognitive Ability	(a) WAIS Score[b]
			(b) 'Missing' Indicator for WAIS Score
11	2	Economic Well-Being: Resources	(a) Dummies for belonging to middle and top third of the net worth distribution (omitted: bottom third)
			(b) 'Missing' Indicator for Net Worth
	4	Economic Well-Being: Health Insurance	(a) Indicator: Whether has federal insurance (Medicare, Medicaid, Champus, VA or other military programs) (b) Indicator: Whether has employer-provided insurance (either self or spouse) (c) Indicator: Whether has directly purchased insurance (from an insurance company or an organization like AARP)
			(d) 'Missing' Indicator for above variables
	8	Econ. Well-Being: Econ. Hardship Percep.	(a) Indicator: Dissatisfied with current financial situation
			(b) Indicator: Financial condition has worsened over last 2 years
			(c) Indicator: Financial condition is expected to worsen over next 2 years
			(d) 'Missing' Indicator for above variables
12	2	Behaviors: Smoking, Drinking, Exercise	(a) Indicator: Smokes now
			(b) Indicator: Drinks Rarely (Omitted: Never Drinks)
			(c) Indicator: Drinks Some
			(d) Indicator: Drinks Many
			(e) Indicator: Does light exercise
			(f) Indicator: Does vigorous exercise
			(g) Indicator: Does housework

[a] The Baseline regressions are the same as reported in Table 5, col. (1). Controls for female, black, hispanic, birth yr. and self-reported health in 1992 are used.

[b] Including dummies for the middle and upper third of the WAIS score distribution (instead of the actual WAIS score) in Table 10, col. (2) alters the baseline education coefficients in the wrong direction. The current specification is used in order to generate an upper limit of the importance of cognitive ability as an explainer of the gradient.

Data Appendix I (contd.): Controls Used For Different Mechanisms in Panel A, Tables 10 - 14

Table	Column	Mechanism	Controls other than those in Baseline (col. 1) All variables are from Wave 1 (1992)
13	2	Risk Preference	(a) Dummies for variable[c] 'Risklove' = 2, 3 and 4 (Omitted: 'Risklove' = 1)
			(b) 'Missing' Indicator for above variables
	4	Value of Future	(a) Dummies for variable[c] 'Valfuture' = 2, 3, 4 and 5 (Omitted: `Valfuture' = 1)
			(b) 'Missing' Indicator for above variables
14	2	Social Connectedness	(a) Indicator: Has relatives in neighborhood
			(b) Indicator: Has good friends in neighborhood
			(c) Indicator: Knows some neighbors by name
			(d) Indicator: Makes social visits to neighbors
			(e) Indicator: Not satisfied with friendships
			(e) Indicator: Not satisfied with family life
			(f) Indicator: Expects friends/ family to help in financial need
			(g) Missing Indicator for above variables

Note: In regressions that control for more than one mechanism, the superset of controls listed above for each of the mechanisms is used.

[c] See Data Appendix II for variable definitions.

Data Appendix II: Definitions of Variables Used to Measure Different Mechanisms

All variables are taken from Wave 1 of HRS (1992).

1. Cognitive Ability

(i) Variable Definition: Wechsler Adult Intelligence Score (WAIS) provided in HRS (takes values 0-14)

2. Economic Well-Being

(i) Resource Availability: Data on household net worth provided in HRS

Variable Definition: Dummies for the lowest third, middle third and upper third of the net worth distribution.

(ii) Access to Health Insurance: Three variables are defined using questions given below.

a. Question: Are you currently covered by any federal government health insurance programs, such as Medicare, Medicaid, or CHAMPUS, VA, or other military programs?

Variable Definition: Indicator for answer 'yes'.

b. Question: Do you have any type of health insurance coverage obtained through your [or your (husband's/wife's/partner's)] employer, former employer or union, such as Blue Cross-Blue Shield or a Health Maintenance Organization?

Variable Definition: Indicator for answers 'yes', 'yes, only when R is working' or 'not now, but when R returns to job he/she will be covered; will be covered on current job in near future'.

c. Do you have any type of health insurance coverage, Medigap or other supplemental coverage, or long-term care insurance that is purchased directly from an insurance company or through a membership organization such as AARP (the American Association of Retired Persons)?

Variable Definition: Indicator for answer 'yes'.

(iii) Perceptions of Economic Hardship: Three indicator variables are defined based on the following questions.

a. Question: Are you very satisfied, somewhat satisfied, about evenly satisfied and dissatisfied, somewhat dissatisfied, or very dissatisfied with your financial situation?

Variable Definition: Indicator for answers 'somewhat dissatisfied' or 'very dissatisfied'.

b. Question: Compared to two years ago, are you [and your (husband/wife/partner)] financially much better off, somewhat better off, about the same, somewhat worse off, or much worse off?

Variable Definition: Indicator for answers 'somewhat worse off' or 'much worse off'.

c. Question: Looking ahead to two years from now, do you think you [and your (husband/wife/partner)] will be financially much better off, somewhat better off, about the same, somewhat worse off, or much worse off?

Variable Definition: Indicator for answers ‘somewhat worse off’ or ‘much worse off’.

3. Health Behaviors: Smoking, Drinking Habits and Exercise Habits

(i) Smoking: One indicator variable is defined as follows.

Variable Definition: Indicator for whether the respondent smokes now (in Wave 1)

(ii) Drinking Habits: Four indicator variables are defined based on two questions, as follows.

a. Question: Do you ever drink any alcoholic beverages such as beer, wine, or liquor?
b. Question: In general, do you have less than one drink a day, one to two drinks a day, three or four drinks a day, or five or more drinks a day?

Variable Definitions: Indicator of ‘never drinks’ for answer ‘no’ to (a).
Indicator of ‘rarely drinks’ for answers ‘yes’ to (a) and ‘less than once a day’ to (b).
Indicator of ‘drinks some’ for answers ‘yes’ to (a) and ‘1-2 a day’ to (b).
Indicator of ‘drinks many’ for answers ‘yes’ to (a) and ‘3-4 a day’ or ‘5 or more a day’ to (b).

(iii) Exercise Habits: Three indicator variables are defined based on the following questions.

a. Question: How often do you participate in light physical activity--such as walking, dancing, gardening, golfing, bowling, etc.? (Would you say 3 or more times a week, 1 or 2 times a week, 1 to 3 times a month, less than once a month, or never?)

Variable Definition: Indicator of ‘light exercise’ for answers ‘3+ times a week’ or ‘1-2 times a week’.

b. Question: How often do you participate in vigorous physical exercise or sports such as aerobics, running, swimming, or bicycling? (Would you say 3 or more times a week, 1 or 2 times a week, 1 to 3 times a month, less than once a month, or never?)

Variable Definition: Indicator of ‘vigorous exercise’ for answers ‘3+ times a week’ or ‘1-2 times a week’.

c. Question: How often do you do heavy housework like scrubbing floors or washing windows?

Variable Definition: Indicator of ‘does housework’ for answers ‘3+ times a week’ or ‘1-2 times a week’.

4. Risk Preferences and Value of Future

(i) Risk Preferences: Four indicator variables are defined based on two questions, as follows.

a. Question: Suppose that you are the only income earner in the family, and you have a good job guaranteed to give you your current (family) income every year for life. You are given the opportunity to take a new and equally good job, with a 50-50 chance it will double your (family) income and a 50-50 chance that it will cut your (family) income by a third. Would you take the new job?
b. Question (b.i) is asked if the answer to (a) is ‘yes’ and question (b.ii) is asked if the answer to (a) is ‘no’

i. Question: Suppose the chances were 50-50 that it would double your (family) income, and 50-50 that it would cut it in half. Would you still take the new job?
ii. Question: Suppose the chances were 50-50 that it would double your (family) income and 50-50 that it would cut it by 20 percent. Would you then take the new job?

Variable Definition: First define the variable 'risklove' as follows:

Risklove = 4 if answers to (a) and (b.i) are 'yes'.
Risklove = 3 if the answer to (a) is 'yes' and (b.i) is 'no'
Risklove = 2 if the answer to (a) is 'no' and (b.ii) is 'yes'
Risklove = 1 if answers to (a) and (b.ii) are 'no'.

Then define four dummies for each category of the variable 'Risklove'. Note that the higher the value of 'Risklove' the lower the risk aversion of the respondent.

(ii) Value of Future: Five indicator variables are defined based on the following question.

a. Question: In deciding how much of their (family) income to spend or save, people are likely to think about different financial planning periods. In planning your (family's) saving and spending, which of the time periods listed in the booklet is most important to you [and your (husband/wife/partner)]?

Variable Definition: First define the variable 'Valfuture' as follows:

Valfuture = 1 if the answer to (a) is 'next few months'
Valfuture = 2 if the answer to (a) is 'next year'
Valfuture = 3 if the answer to (a) is 'next few years'
Valfuture = 4 if the answer to (a) is 'next 5-10 years'
Valfuture = 5 if the answer to (a) is 'longer than 10 years'

Then define five dummies for each category of the variable 'Valfuture'. Note that the higher the value of 'Valfuture' the more the respondent values the future.

5. Social Connectedness: Seven indicator variables are defined based on the following questions.

a. Question: Besides the people living here with you, do you have any relatives in this neighborhood?

Variable Definition: Indicator for answer 'yes'.

b. Question: Do you have any good friends living in this neighborhood?

Variable Definition: Indicator for answer 'yes'.

c. Question: Among your nearby neighbors, that is, the ten to fifteen families living closest to you, how many of the adults would you know by name if you met them on the street: all of them, most of them, some of them, or none of them?

Variable Definition: Indicator for answers 'some of them', 'most of them' or 'all of them'.

d. How often do you get together with any of these neighbors just to chat or for a social visit: daily or almost every day, several times a week, several times a month, several times a year, or hardly ever?

Variable Definition: Indicator for answers 'daily' or 'almost every day' or 'several times a week' or 'several times a month' or 'several times a year'.

e. Are you very satisfied, somewhat satisfied, about evenly satisfied and dissatisfied, somewhat dissatisfied, or very dissatisfied with your friendships?

Variable Definition: Indicator for answers ‘somewhat dissatisfied’ or ‘very dissatisfied’.

f. Are you very satisfied, somewhat satisfied, about evenly satisfied and dissatisfied, somewhat dissatisfied, or very dissatisfied with your family life?

Variable Definition: Indicator for answers ‘somewhat dissatisfied’ or ‘very dissatisfied’.

g. Suppose you [and your (husband/wife/partner)] ran into severe financial problems in the future. Do you have relatives or friends who would be both willing and able to help you out over a long period of time?

Variable Definition: Indicator for answer ‘yes’.

Table 1: Summary Statistics for Respondents in the Sample (n = 862).
Respondents are diabetics in the baseline wave (1992)[a].

Variable	Mean	Std. Dev.	Proportion Missing
Female	0.531	0.499	-
Black	0.277	0.448	-
Hispanic	0.126	0.333	-
Birth Year:			
Before 1935	0.447	0.497	-
1935-37	0.204	0.403	-
1938+	0.349	0.477	-
Education:			
0-11 years	0.401	0.49	-
12 years	0.311	0.463	-
13-15 years	0.164	0.37	-
16+ years	0.124	0.33	-
Self reported health in 1992:			
Excellent	0.037	0.189	-
Very Good	0.148	0.356	-
Good	0.304	0.46	-
Fair	0.318	0.466	-
Poor	0.193	0.395	-
Poor Adherence Behavior[b]:			
A (stops treatment completely after having started on something)	0.068	0.253	0.055
B (switches treatment regimens, then returns to original regimen)	0.072	0.259	0.013
C (adds a second regimen to the first)	0.167	0.373	0.059
A/B/C	0.235	0.425	0.055
A/B	0.119	0.325	0.055
A/C	0.231	0.422	0.055
B/C	0.193	0.395	0.059
A alone (not B or C)	0.043	0.203	0.059
B alone (not A or C)	0.005	0.068	0.055
C alone (not A or B)	0.116	0.320	0.055
Marital Status:			
Married in 1992	0.754	0.431	-
Married in 1998	0.704	0.457	-
Married in 1992, not married in 1998	0.065	0.247	-
Not married in 1992, married in 1998	0.015	0.122	-
Married in 1992 and 1998	0.689	0.463	-
Female, married in 1992, not married in 1998	0.042	0.2	
Potential Mechanisms: All Variables Below are Taken from Wave 1 (1992)			
Cognitive Ability: Test Score			
WAIS score (Values: 0-14)	4.871	3.384	
WAIS missing	0.119	0.325	

[a] Individuals who report in wave 4 (1998) that they have never been diagnosed with diabetes -- but report diabetes in wave 1 -- are dropped. This is the closest approximation to Goldman & Smith's (2002) sample where n = 869. Results are similar even when these individuals are included or when individuals with conflicting reports in the middle waves are dropped.

[b] X/Y represents an indicator for engaging in at least one of the practices X or Y.

Table 1 (contd.): Summary Statistics (n = 862)
All Variables Below are Taken from Wave 1 (1992)

	Mean	Std Dev
Net worth of household:		
Less than $26,500	0.332	0.471
$ 26,500-108,730	0.340	0.474
$108,730+	0.328	0.470
Net worth missing	0.005	0.068
Access to Health Insurance:		
Has federal insurance	0.241	0.428
Has employer-providedinsurance	0.622	0.485
Has directly-purchased insurance	0.137	0.344
Any insurance variable missing	0.012	0.107
Perceptions of Economic Hardship:		
Not satisfied with financial situation	0.321	0.467
Financial condition worsened in last 2 years	0.254	0.436
Expects financial condition to worsen in next 2 years	0.118	0.323
Any perception of econ. hardship variable missing	0.038	0.192
Health Behaviors:		
Smokes now	0.224	0.417
Never drinks	0.577	0.494
Rarely drinks	0.346	0.476
Drinks Some	0.051	0.220
Drinks Many	0.027	0.161
Does light exercise	0.694	0.461
Does vigorous exercise	0.135	0.341
Does housework	0.276	0.447
Any health behavior variable missing	0.000	0.000
Risk Preferences:		
Indicator: Var. Risklove = 1 (highest risk aversion)	0.677	0.468
Indicator: Var. Risklove = 2	0.092	0.289
Indicator: Var. Risklove = 3	0.107	0.309
Indicator: Var. Risklove = 4 (lowest risk aversion)	0.124	0.330
Variable Risklove missing	0.067	0.251
Value of Future:		
Indicator: Var. Valfuture = 1 (lowest value of future)	0.285	0.452
Indicator: Var. Valfuture = 2	0.115	0.319
Indicator: Var. Valfuture = 3	0.323	0.468
Indicator: Var. Valfuture = 4	0.217	0.412
Indicator: Var. Valfuture = 5 (highest value of future)	0.060	0.238
Variable Valfuture missing	0.071	0.257
Social Connectedness:		
Has relatives in neighborhood	0.253	0.435
Has good friends in neighborhood	0.411	0.492
Knows some neighbours by name	0.546	0.498
Makes social visits to neighbors	0.371	0.483
Not satisfied with friendships	0.042	0.200
Not satisfied with family life	0.049	0.215
Expects help from family/ friends if in financial need	0.368	0.482
Any social connectedness variable missing	0.477	0.500

Table 2: Baseline Health Conditions and Poor Self-Maintenance Behavior (A/B/C) for Sample Respondents (n = 862)

	1992 Comorbidities - 1[a]		1992 Comorbidities - 2[b]	
A/B/C	None	At least one	None	At least one
Yes	16.1	24.7	13.1	26.8
z (H_1: Perc. with cond. > Perc. without cond.)	-2.053		-4.049	
P-value	0.020		0.000	

	ADL (1992)[c]		BMI (1992)[d]	
A/B/C	None	At least one	Below 35	Above 35
Yes	18.6	27.2	22.1	28.4
z (H_1: Perc. with cond. > Perc. without cond.)	-2.917		-1.835	
P-value	0.002		0.033	

	Depression (1992)[e]	
A/B/C	None	At least one
Yes	17.6	25.9
z (H_1: Perc. with cond. > Perc. without cond.)	-2.616	
P-value	0.005	

P-values are for the alternative hypothesis that the percentage of poor self-managers (A/B/C) is higher in the group that suffers from the health condition than the group that does not.

[a] Includes hypertension, cancer, chronic lung condition (except asthma), heart condition, stroke, arthritis and psychiatric condition.

[b] Includes asthma, high cholesterol and problems relating to back, feet, bladder, stomach.

[c] Respondent finds at least one of 17 activities of daily living very difficult to perform (or "can't do").

[d] BMI of 35 denotes the threshold for Type 2 obesity.

[e] Respondent admits to at least one of 14 "feelings" of depression.

Replication of Goldman and Smith (2002)

Table 3: Self-Reported Health Status (SRHS) for all HRS respondents and those with diabetes at baseline

	Years of schooling			
Baseline health status	0-11	12	13-15	16+
All HRS respondents, tracked in waves 1-4				
Excellent	11.4	22.8	28.8	38
Very Good	19	31.5	33.6	35.1
Good	31.8	28.9	26.3	20.8
Fair	23.8	12.1	8.6	4.4
Poor	14	4.6	2.7	1.7
Diabetics in wave 1, tracked in waves 1-4				
Excellent	1.2	3.4	7.8	7.5
Very Good	9	13.1	21.3	29.9
Good	20.5	38.1	34.8	37.4
Fair	39.9	30.2	26.2	16.8
Poor	29.5	15.3	9.9	8.4

In Table 3, columns add to 100 in each panel.

Replication of Goldman and Smith (2002)

Table 4: Patterns of Treatment among Diabetics at baseline

Education	Always	Never	Switches
Takes oral medication			
0-11	31.5	21.1	47.4
` 12	31.7	32.1	36.2
13-15	27	35.5	37.6
16+	34.6	36.4	29
Uses insulin			
0-11	24.3	52	23.7
` 12	23.5	57.1	19.4
13-15	14.2	61	24.8
16+	24.3	67	13.1

In Table 4, rows add to 100.

Replication of Goldman and Smith (2002)

Table 5: Predictors of a Change in General Health Status between Wave 1 and Wave 4 (Ordered Probits)

Dependent Variable: Difference in SRHS between waves 1 and 4 [got better (-1), stayed the same (0), got worse (+1)]

	Without Poor Behavior	With Poor Behavior[a]
	(1)	(2)
Years of schooling (excluded, 0-11 years)		
12 yrs	-0.186*	-0.181*
	(0.101)	(0.101)
13-15 yrs	-0.269**	-0.273**
	(0.126)	(0.127)
16+ yrs	-0.199	-0.186
	(0.144)	(0.144)
Poor self-maintenance behavior (A/B/C)	-	0.282**
		(0.098)
Other controls:		
Female	-0.095	-0.103
	(0.084)	(0.085)
Black	0.259***	0.251***
	(0.096)	(0.096)
Hispanic	0.357***	0.374***
	(0.13)	(0.131)
Year of Birth (excluded, before 1935)		
1935-1937	-0.122	-0.14
	(0.108)	(0.108)
1938+	0.142	0.132
	(0.094)	(0.094)
Self-reported health in 1992 (excluded, 'good')		
Excellent	1.670***	1.689***
	(0.323)	(0.325)
Very good	0.800***	0.827***
	(0.138)	(0.139)
Fair	-0.600***	-0.617***
	(0.103)	(0.104)
Poor	-1.409***	-1.480***
	(0.125)	(0.128)
Observations	862	862

Standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%

[a] Goldman and Smith's (2002) regression

Replication of Goldman and Smith (2002)

Table 6: Predictors of Poor Self-Maintenance Behavior, A/B/C (Probits)

Dependent Variable: Indicator for poor self-maintenance behavior (A/B/C)

	Goldman & Smith (2002)
Years of schooling (excluded, 0-11 years)	
12 years	-0.186
	(0.117)
13-15 years	-0.148
	(0.145)
16+ years	-0.363**
	(0.171)
Year of Birth (excluded, before 1935)	
1935-37	0.241*
	(0.126)
1938+	0.156
	(0.113)
Female	0.126
	(0.106)
Black	0.148
	(0.112)
Hispanic	-0.118
	(0.158)
Married waves 1 and 4	-0.045
	(0.118)
Married wave 1 and not married wave 4	0.614**
	(0.307)
Not married wave 1 and married wave 4	-0.057
	(0.414)
Female, married wave 1 and not married wave 4	-0.536
	(0.372)
Observations	862

Standard Errors in Parentheses.

* significant at 10%, ** significant at 5%; *** significant at 1%

Table 7: Predictors of a Change in General Health Status using Alternative Definitions of 'Poor' Self-Maintenance Behavior

Dependent Variable: Difference in SRHS between waves 1 and 4 [got better (-1), stayed the same (0), got worse (+1)]

	Panel A: Individual behaviors			Panel B: Combinations of behaviors[a]			
	A	B	C	A/B	A/C	B/C	A/B/C[b]
Poor self-maintenance behavior (as per column header)	-0.07	0.381**	0.408***	0.17	0.282***	0.388***	0.282***
	(0.16)	(0.16)	(0.112)	(0.127)	(0.099)	(0.106)	(0.098)
Education (excluded, 0-11 years)							
12 years	-0.186*	-0.183*	-0.182*	-0.186*	-0.183*	-0.177*	-0.181*
	(0.101)	(0.101)	(0.101)	(0.101)	(0.101)	(0.101)	(0.101)
13-15 years	-0.267**	-0.259**	-0.270**	-0.270**	-0.274**	-0.266**	-0.273**
	(0.126)	(0.127)	(0.127)	(0.126)	(0.127)	(0.127)	(0.127)
16+ years	-0.2	-0.191	-0.199	-0.193	-0.189	-0.19	-0.186
	(0.144)	(0.144)	(0.144)	(0.144)	(0.144)	(0.144)	(0.144)
Observations	862	862	862	862	862	862	862

Standard errors in parentheses.

* significant at 10%; ** significant at 5%; *** significant at 1%

Note: The estimates are from ordered probits of change in general health. Other controls are gender, race, year of birth and indicators for SRHS in the baseline wave, as in Table 5.

[a] X/Y represents an indicator for engaging in at least one of the practices X or Y. Practices A, B and C are defined in Table 1.

[b] Goldman and Smith's (2002) regression, Table 5, col. (2)

Table 8: Predictors of Self-Maintenance Behavior, using Alternative Definitions of 'Poor' Behavior

Dependent Variable: Indicator for poor self-maintenance behavior, as defined by the column header.

	Panel A: Individual behaviors			Panel B: Combinations of behaviors[a]			
	A	B	C	A/B	A/C	B/C	A/B/C[b]
Education (excluded, 0-11 years)							
12 years	-0.042	-0.11	-0.171	-0.07	-0.173	-0.206*	-0.186
	(0.162)	(0.16)	(0.128)	(0.138)	(0.118)	(0.124)	(0.117)
13-15 years	0.018	-0.239	-0.203	-0.077	-0.178	-0.199	-0.148
	(0.196)	(0.213)	(0.16)	(0.171)	(0.146)	(0.153)	(0.145)
16+ years	-0.513*	-0.242	-0.165	-0.354	-0.352**	-0.246	-0.363**
	(0.283)	(0.243)	(0.18)	(0.215)	(0.171)	(0.175)	(0.171)
Observations	862	862	862	862	862	862	862
Chi-square for Education Dummies	3.62	1.84	2.62	2.7	5.09	3.95	5.4
(Prob > Chi-square)	(0.305)	(0.607)	(0.455)	(0.44)	(0.165)	(0.267)	(0.145)

Standard errors in parentheses.

* significant at 10%; ** significant at 5%; *** significant at 1%

Note: This table shows results from probit regressions of whether the patient followed a poor treatment regimen. Other controls are year of birth, gender and indicators of marital status, as in Table 6.

[a] X/Y represents an indicator for engaging in at least one of the practices X or Y. Practices A, B and C are defined in Table 1.

[b] Goldman and Smith's (2002) regression, Table 6

Replication of Goldman and Smith (2002) For HIV+ Patients (HCSUS)[a]

Table 9: Predictors of a Change in General Health Status between Wave 1 and Wave 3 (Ordered Probits)

Dependent Variable: Difference in SRHS between waves 1 and 3 [got better (-1), stayed the same (0), got worse (+1)]. Column headers denote controls.

	(1)	(2)	(3)
	Goldman and Smith (2002)	All Controls in (1) Except Using HAART/ Using HAART & Adhering	Drop in coef. in (1) vs. (2)
Yrs. of Schooling: (Excl. 0-11 yrs)			
12 years	0.174	0.169	-0.030
	(0.147)	(0.147)	
13-15 years	0.020	0.015	-0.333
	(0.132)	(0.132)	
16+ years	-0.054	-0.055	0.018
	(0.144)	(0.146)	
Black	0.015	0.011	
	(0.073)	(0.074)	
Female	0.973***	0.951***	
	(0.283)	(0.277)	
Using HAART[b]	0.041		
	(0.068)	-	
Using HAART and Adhering[c]	-0.232***	-	
	(0.077)		
Observations	1608	1608	

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Other controls are the same as in Goldman and Smith (2002), Appendix 1 (age, age-squared, census region, baseline CD4 count range, baseline health, insurance, income, whether used intravenous drugs and whether male and had sex with another male).

The mean (std. deviation) of the above variables are as follows:
Schooling - 0-11 yrs: 0.241 (0.428); 12 yrs: 0.277 (0.447); 13-15 yrs: 0.290 (0.454), 16+ yrs: 0.192 (0.394);
Black: 0.312 (0.463); Female: 0.293 (0.455); Using HAART: 0.611 (0.488); Using HAART & Adhering: 0.215 (0.411);
Change in health (dep. Var.): -0.112 (0.787)

[a] Note that Goldman and Smith do not provide the number of observations in the HCSUS regressions they report. Also some variable definitions used in their paper are ambiguous given the information available in the survey. Hence the attempted replications of Goldman and Smith's results may not be perfect.

[b] The definition of HAART involves the use of various combinations of protease inhibitors, nucleoside reverse transcriptase inhibitors and non-nucleoside transcriptase inhibitors. I use, here, the variable provided by HCSUS authorities identifying HAART patients. Their definition matches that used by Andersen et al (2000).

[c] To measure adherence, I use respondents' answer to the question: "Many people don't take their medication perfectly all the time. Over the past week, how many days did you take HIV medication exactly as your doctor prescribed you to take it?" A patient is identified as adherent if the answer to this question is 7 for each of the medications she is prescribed *and* she does not report having missed (forgotten or ignored) medications on any day of the past week (in answer to a series of other questions).

Table 10: Cognitive Ability

PANEL A[a]: Impact of Cognitive Ability on the Gradient, Ordered Probits (Obs. = 862)

Dependent Variable: Difference in SRHS between waves 1 and 4 [got better (-1), stayed the same (0), got worse (+1)]. Column headers denote controls.

	(1)	(2)	(3)
	Baseline (Tab. 5, col. (1))	WAIS only	Drop in coef. in (2) vs. (1)
Yrs. of Schooling: (Excl. 0-11 yrs)			
12 years	-0.186*	-0.169*	0.091
	(0.101)	(0.103)	
13-15 years	-0.269**	-0.24*	0.108
	(0.126)	(0.131)	
16+ years	-0.199	-0.159	0.201
	(0.144)	(0.156)	

PANEL B[a]: Impact of Education on Measures of Cognitive Ability, Ordered Probit

Dependent Variable:	WAIS
Yrs. of Schooling: (Excl. 0-11 yrs)	
12 years	0.562***
	(0.094)
13-15 years	0.918***
	(0.113)
16+ years	1.474***
	(0.129)
Observations	759

Standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%
Controls used and variable definitions are provided in Data Appendix I and II.

[a] Each regression in Panel A includes an indicator for missing observations of controls. Missing obs. are dropped in Panel B. Panel B controls are the same as in Table 6.

Table 11: Economic Well-Being

PANEL A[a]: Impact of Economic Well-Being on the Gradient, Ordered Probits (Obs. = 862)

Dependent Variable: Difference in SRHS between waves 1 and 4 [got better (-1), stayed the same (0), got worse (+1)]. Column headers denote controls.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Baseline (Tab. 5, col. (1))	Net Worth Dummies Only	Drop in Coef. in (2) vs. (1)	Health Insurance Vars. Only	Drop in Coef. in (4) vs. (1)	Net Worth Dummies & Insurance	Drop in Coef. in (6) vs. (1)	Perceptions of Econ. Hardship Only	Drop in Coef. in (8) vs. (1)
Yrs. of Schooling (Excl. 0-11 yrs)									
12 years	-0.186*	-0.122	0.344	-0.135	0.274	-0.091	0.511	-0.193*	-0.038
	(0.101)	(0.103)		(0.103)		(0.104)		(0.101)	
13-15 years	-0.269**	-0.184	0.316	-0.211*	0.216	-0.151	0.439	-0.301**	-0.119
	(0.126)	(0.129)		(0.128)		(0.13)		(0.127)	
16+ years	-0.199	-0.083	0.583	-0.118	0.407	-0.037	0.814	-0.186	0.065
	(0.144)	(0.147)		(0.147)		(0.149)		(0.144)	

PANEL B[a]: Impact of Education on Measures of Economic Well-Being, Ordered Probits/ Probits

Dependent Variable:	Rank N. Worth[b]	N. Worth Dummy: Lowest 3rd	N. Worth Dummy: Middle 3rd	N. Worth Dummy Top 3rd	Has Federal Insurance	Has Employer-Provided Insurance	Has Directly Purchased Insurance	Dissatisfied w. Financial Situation	Financial Cond. Worsened in Last 2 Yrs	Financial Cond. Will Worsen in Next 2 Yrs
Yrs. of Schooling (Excl. 0-11 yrs)										
12 years	0.535***	-0.590***	0.134	0.481***	-0.194	0.619***	0.166	-0.136	-0.08	-0.128
	(0.101)	(0.121)	(0.111)	(0.125)	(0.121)	(0.115)	(0.144)	(0.116)	(0.118)	(0.139)
13-15 years	0.760***	-0.787***	0.076	0.710***	-0.057	0.638***	0.321*	0.021	-0.129	-0.166
	(0.123)	(0.152)	(0.136)	(0.145)	(0.147)	(0.14)	(0.165)	(0.14)	(0.145)	(0.172)
16+ years	1.052***	-1.120***	-0.046	0.988***	-0.314*	0.861***	0.487***	-0.428**	-0.253	-0.371*
	(0.141)	(0.193)	(0.155)	(0.161)	(0.177)	(0.168)	(0.175)	(0.169)	(0.168)	(0.208)
Observations	858	858	858	858	852	856	858	833	833	845

Standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%

[a] Each regression in Panel A includes an indicator for missing observations of controls. Missing observations are dropped in Panel B. Panel B controls are the same as in Table 6.

[b] Rank N. Worth takes values 1-3 for the lowest, middle and top 3rd of the net worth distribution, respectively. See Data Appendix I and II for details.

Table 12: Health Behaviors

PANEL A[a]: Impact of Health Behaviors on the Gradient, Ordered Probits (Obs. 862)

Dependent Variable: Difference in SRHS between waves 1 and 4 [got better (-1), stayed the same (0), got worse (+1)]. Column headers denote controls.

	(1)	(2)	(3)
	Baseline (Tab. 5, col. (1))	Smoking, Drinking, Exercise	Drop in Coef. in (2) vs. (1)
Yrs. of Schooling (Excl. 0-11 yrs)			
12 years	-0.186*	-0.186*	0.000
	(0.101)	(0.101)	
13-15 years	-0.269**	-0.253**	0.059
	(0.126)	(-0.128)	
16+ years	-0.199	-0.175	0.121
	(0.144)	(0.146)	

PANEL B[a]: Impact of Education on Health Behaviors (Obs. 862), Probits

Dependent Variable:	Smokes Now	Never Drinks	Rarely Drinks	Has Some Drinks	Has Many Drinks	Does Light Exercise	Does Vigorous Exercise	Does Housework
Yrs. of Schooling (Excl. 0-11 yrs)								
12 years	0.024	-0.228**	0.159	0.279	-0.092	0.073	0.102	-0.047
	(0.12)	(0.110)	(0.112)	(0.192)	(0.268)	(0.112)	(0.138)	(0.115)
13-15 years	-0.08	-0.488***	0.488***	-0.007	0.007	-0.052	0.205	-0.286*
	(0.148)	(0.134)	(0.134)	(0.252)	(0.292)	(0.135)	(0.162)	(0.15)
16+ years	-0.087	-0.435***	0.296**	0.4*	0.063	0.536***	0.335*	-0.255
	(0.164)	(0.150)	(0.150)	(0.232)	(0.295)	(0.170)	(0.176)	(0.174)

Standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%

Controls used and variable definitions are provided in Data Appendix I and II.

[a] Each regression in Panel A includes an indicator for missing observations of controls. Missing observations are dropped in Panel B. Panel B controls are the same as in Table 6.

Table 13: Risk Preferences and Value of Future

PANEL A[a]: Impact of Risk Preference and Value of Future on the Gradient, Ordered Probits (Obs. 862).

Dependent Variable: Difference in SRHS between waves 1 and 4 [got better (-1), stayed the same (0), got worse (+1)]. Column headers denote controls.

	(1)	(2)	(3)	(4)	(5)
	Baseline (Tab. 5, col. (1))	Dummies for Risk Preference Only	Drop in Coef. in (2) vs. (1)	Dummies for Value of Future Only	Drop in Coef. in (4) vs. (1)
Yrs. of Schooling (Excl. 0-11 yrs)					
12 years	-0.186*	-0.183*	0.016	-0.185*	0.005
	(0.101)	(0.101)		(0.102)	
13-15 years	-0.269**	-0.26**	0.033	-0.271**	-0.007
	(0.126)	(0.127)		(0.127)	
16+ years	-0.199	-0.187	0.060	-0.187	0.060
	(0.144)	(0.145)		(0.145)	

PANEL B[a]: Impact of Education on Risk Preference and Value of Future, Ordered Probits/ Probits

Dependent Variable:	Risk Love Scale[b]	Dummy: Risk Love=1	Dummy: Risk Love=2	Dummy: Risk Love=3	Dummy: Risk Love=4	Future Value Scale[b]	Dummy: Future Value=1	Dummy: Future Value=2	Dummy: Future Value=3	Dummy: Future Value=4	Dummy: Future Value=5
Yrs. of Schooling (Excl. 0-11 yrs)											
12 years	-0.057	0.027	0.109	-0.014	-0.13	0.183*	-0.243**	0.156	-0.108	0.356***	-0.071
	(0.108)	(0.115)	(0.154)	(0.145)	(0.145)	(0.094)	(0.122)	(0.142)	(0.115)	(0.129)	(0.181)
13-15 years	-0.144	0.171	-0.033	-0.23	-0.057	0.257**	-0.286*	-0.057	-0.127	0.585***	-0.282
	(0.133)	(0.14)	(0.196)	(0.183)	(0.172)	(0.114)	(0.153)	(0.182)	(0.139)	(0.148)	(0.237)
16+ years	0.069	-0.061	0.22	-0.257	0.151	0.469***	-0.401**	-0.024	-0.279*	0.533***	0.314
	(0.144)	(0.153)	(0.203)	(0.204)	(0.185)	(0.127)	(0.176)	(0.2)	(0.158)	(0.164)	(0.21)
Observations	804	804	804	804	804	801	801	801	801	801	801

Standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%

Controls used and variable definitions are provided in Data Appendix I and II.

[a] Each regression in Panel A includes an indicator for missing observations of controls. Missing observations are dropped in Panel B. Panel B controls are the same as in Table 6.

[b] Risk Love Scale takes values 1-4, higher values indicating lower risk aversion. Future Value Scale takes values 1-5, higher values representing longer planning horizons.

Table 14: Social Connectedness

PANEL A[a]: Impact of Social Connectedness on the Gradient, Ordered Probits (Obs. 862)

Dependent Variable: Difference in SRHS between waves 1 and 4 [got better (-1), stayed the same (0), got worse (+1)]. Column headers denote controls.

	(1)	(2)	(3)
	Baseline (Tab. 5, col. (1))	Social Connectedness	Drop in Coef. in (2) vs. (1)
Yrs. of Schooling (Excl. 0-11 yrs)			
12 years	-0.186*	-0.179*	0.038
	(0.101)	(0.102)	
13-15 years	-0.269**	-0.272**	-0.011
	(0.126)	(0.127)	
16+ years	-0.199	-0.167	0.161
	(0.144)	(0.146)	

PANEL B[a]: Impact of Education on Social Connectedness, Probits

Dependent Variable:	Has Relatives in Neighborhood	Has Good Friends in Neighborhood	Knows Some Neighbors by Name	Makes Social Visits to Neighbors	Not Satisfied with Friendships	Not Satisfied with Family Life	Expects Help from Family/ Friends in Financial Need
Yrs. of Schooling (Excl. 0-11 yrs)							
12 years	-0.305**	-0.044	0.027	0.015	-0.011	0.088	0.111
	(0.134)	(0.143)	(0.2)	(0.148)	(0.192)	(0.189)	(0.111)
13-15 years	-0.19	-0.363**	0.016	-0.316*	-0.19	-0.377	-0.029
	(0.176)	(0.177)	(0.263)	(0.184)	(0.259)	(0.28)	(0.135)
16+ years	-1.486***	-0.56**	-0.086	-0.414*	-0.606	-0.278	0.166
	(0.313)	(0.226)	(0.315)	(0.235)	(0.409)	(0.297)	(0.149)
Observations	513	513	477	468	833	820	846

Standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%

Controls used and variable definitions provided in Data Appendix I and II.

[a] Each regression in Panel A includes an indicator for missing observations of controls. Missing obs. are dropped in Panel B. Panel B controls are the same as in Table 6.

Table 15: Impact of Resources, Insurance, Cognition, Risk Preferences and Health Behaviors on the Gradient, Ordered Probits

Dependent Variable: Difference in SRHS between waves 1 and 4 [got better (-1), stayed the same (0), got worse (+1)]. Column headers denote controls.

	(1)	(2)	(3)
	Baseline (Tab. 5, col. (1))	All Mechanisms[a]	Drop in Coef. in (2) vs. (1)
Yrs. of Schooling (Excl. 0-11 yrs)			
12 years	-0.186*	-0.08	0.570
	(0.101)	(0.106)	
13-15 years	-0.269**	-0.12	0.554
	(0.126)	(0.135)	
16+ years	-0.199	0	1.000
	(0.144)	(0.162)	
Observations	862	862	

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Controls used and variable definitions are provided in Data Appendix I and II.

[a] Controls (beyond those in the baseline regression) include measures of resources, insurance access, cognition, risk preferences, health behaviors and missing indicators for each of these mechanisms.